Educational and behavioural problems in babies of 32–35 weeks gestation

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Abstract

Aim—To identify incidence of school and behaviour problems at age 7 years in children born between 32 and 35 weeks gestation, and investigate perinatal risk factors.

Method—The study population consisted of all children born at 32–35 weeks gestation to mothers resident in Oxfordshire in l990. General practitioners, parents, and teachers were asked about health, behaviour, and education by postal questionnaire. Teachers rated children on level of function in six areas using a five point scale. They also completed the Strengths and Difficulties behaviour questionnaire. Perinatal risk factors were identified for children with poor school performance using a univariate and multivariate analysis.

Results—Teacher responses were obtained for 117 (66%) of the 176 children in the cohort. Twenty nine (25%) required support from a non-teaching assistant, five (4%) had required a statement of special educational needs, and three (3%) were at special school. Poor outcome was reported for 32% in writing, 31% in fine motor skills, 29% in mathematics, 19% in speaking, 21% in reading, and 12% in physical education. On the behaviour questionnaire, 19% of the cohort achieved an abnormal hyperactivity score (population norm 10%). Multivariate analysis showed perinatal variables that remained significant, independent of other variables; they were discharge from the special care baby unit > 36 weeks postconceptional age (odds ratio 4.15; 95% confidence interval 1.43 to 12.05) and male sex (odds ratio 3.88; 95% confidence interval 1.42 to 10.6).

Conclusion—Up to a third of children born between 32 and 35 weeks gestation may have school problems. As there are larger numbers in this gestational category compared with smaller babies, this finding has implications for educational services.

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Keywords: preterm; behaviour; education; follow up study; risk factors

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Preterm and low birthweight babies are at increased risk of motor and sensory neurodevelopmental problems, educational difficulties, and behavioural disorders.[1–5] The school age outcomes of children born at a very low birth weight (< 1500 g) or very premature (< 32 weeks gestation) have been widely reported.[2–7] More subtle long term morbidities have been identified, including difficulties in areas of learning and academic achievement, visuomotor integration, and language skills.[7–9] Minor developmental abnormalities, motor delay, and behavioural problems have also been noted.[4 5 10–14] There is relatively little information, however, about the longer term outcome of larger preterm babies, born between 32 and 35 weeks gestation. Most of these babies survive, many with an uncomplicated neonatal period. They are generally considered to be at low risk of later neurodevelopmental problems and are not usually followed up. Apart from those with obvious serious motor or sensory disorders, most are placed in normal mainstream school and are assumed to have a good outcome, not differing from their term peers. Although many of these children do well, information from large population studies and registers of impairment and disability, such as cerebral palsy registers, indicate that babies born between 32 and 35 weeks gestation do have a higher incidence of later problems than babies born at term.[15–17] As the number of surviving children in this intermediate gestational age group is much higher than the number of surviving babies born before 32 weeks gestation, even a modest increase in the risk of preschool or school difficulties will have considerable resource implications, as well as being important for parents and children themselves.

Previous studies of outcome at school age in children born very preterm have tended to be small, used a wide range of psychometric methods, and, in general, have been based on a highly selected population attending a tertiary centre.[2 3 9] We decided to explore a different methodology, using a simple, inexpensive questionnaire method of follow up on a relatively large sample, in order to ascertain the extent of school problems in a geographically defined cohort of children born between 32 and 35 weeks gestation.

Risk factors for adverse school outcome in this group of larger preterm babies are unknown. As many of these babies have an uncomplicated intrapartum and neonatal period, it seems possible that adverse factors in the antenatal period may play an important role in determining outcome. We decided to investigate this by using information from a routinely collected maternity dataset and from maternal and infant medical records. We compared the incidence of antenatal, intrapartum, and neonatal factors in children with an adverse school outcome with those who did not have school problems.

Methods

This is a case-control study nested in a birth cohort. The cohort consisted of all children born during the year 1990 with gestations 32–35 completed weeks to mothers resident in the Oxfordshire district at the time of delivery. Information for most of these was available from OXMAT, a computerised system that records details of all births in the John Radcliffe Hospital. Other births included in the cohort were selected by searching delivery records for the Horton General Hospital, Banbury, community hospitals, and records of all home births. Deliveries to US military personnel in the Upper Heyford US airforce base were excluded. Babies born outside the boundaries but resident in Oxfordshire were located from the community child health service and are included in the study.

Gestational age was verified by mother's last menstrual period, if certain and agreeing within two weeks of ultrasound, or by ultrasound if not. If neither of these were known, gestation according to paediatric assessment was used.

Once the babies were identified, a letter was sent to the families' general practitioners asking them to give permission for us to send a questionnaire to the parents, unless they thought it inappropriate, and return a receipt to us. The general practitioners were asked for basic information about the status of each child.

A questionnaire was sent to the parents with a covering letter explaining the purpose of the project. They were asked to complete and return the questionnaire and give consent for the child's teacher to be contacted. Further questionnaires were then sent directly to the child's school. We informed the parents that a copy of the teacher's report would be made available to them if they wished. This method has been validated and used before for developmental follow up studies.[18]

The questionnaire sent to the parents included questions on health, development, education, and behaviour. It was expected that major disabilities such as cerebral palsy, visual impairment, sensorineural hearing loss, and severe developmental delay would be identified from responses made by parents.

The teachers were asked for information about any additional help the child was receiving at school. They were asked to rate the children on their level of function in six areas—speaking/listening, writing/composition, fine motor skills, mathematics, reading, and physical education—using a five point scale. On this scale a score of 1 indicated good ability, a score of 3 indicated average ability, and a score of 5 indicated very poor ability. The child would be considered to have difficulty in a particular skill if the rating was 4 or 5. The teachers were also asked to complete the Strengths and Difficulties behaviour questionnaire (SDQ).[19] This behaviour questionnaire has five scales covering conduct problems, hyperactivity, emotional symptoms, peer problems, and prosocial behaviour. All but the last can be summed to generate a total problem score. In the standardisation of the behaviour questionnaire, cut off points were selected within each of the subscales so that about 80% of children in the community are normal, 10% are borderline, and 10% are abnormal.[19] School problems in children were defined as those who had (*a*) a score of more than 3 in a skill area as assessed by teachers, (*b*) a requirement for non-teaching assisted support, or (*c*) a borderline or abnormal result on the SDQ. The analysis focused on whether school problems were related to gestational age at birth. We also noted whether health service use was related to gestational age.

Secondary tracing methods were used to find families who could not be traced, through community records, the Family Health Service Authority (FHSA), and the National Health Service Central Register (NHSCR). Those who did not respond to the initial correspondence were sent a second questionnaire. General practitioners and teachers (but not parents) were contacted once by telephone if necessary.

Maternal and neonatal notes were examined in order to collect information on possible antenatal, perinatal, and postnatal risk factors. This information was collected blind to the seven year outcome. To identify perinatal risk factors associated with poor school performance, two children with known abnormalities of chromosome 16 were excluded from the analysis. For this case-control part of the study, we used a high threshold for the definition of school problems. Children with poor school performance were defined as those scoring either 4 or 5 in three or more skill areas, or who were requiring additional help at school (non-teaching assisted support, special schooling, and help as a result of an educational statement). Children who met these criteria were identified as cases and those without poor school performance acted as controls. Results of comparisons of cases and controls were given as odds ratios (OR) with 95% confidence intervals (95% CI). The risk factors were analysed statistically by univariate and multivariate analyses using SPSS for Windows. Definitions of risk factors are listed in the appendix.

Ethical approval for the study was obtained from the central Oxford research ethics committee.

Results

There were 187 babies born to mothers resident in Oxfordshire in 1990. There were six neonatal deaths (two from congenital diaphragmatic hernia, one each with congenital myotonic dystrophy, Potter's syndrome, congenital heart block, and Down's syndrome with hydrops and pulmonary hypoplasia) and five sudden infant deaths (ages two, three, four, five, and seven months). Five percent of children were lost as a result of movement out of the region. The general practitioner response rate was 95%, parent response rate was 81%, and the teacher response rate was 97%. General practitioners suggested that we did not contact eight children (reasons included poor social circumstances, maternal psychiatric illness, recent bereavement, disabled sibling at home, and a family that preferred alternative

Table 1 No (%) children with school problems, as assessed by teachers

	32–35 weeks (n=117)	32 weeks (n=12)	33 weeks (n=22)	34 weeks (n=38)	35 weeks (n=45)
Receiving non-teaching assisted help at school	29 (25)	5 (42)	4 (18)	9 (24)	11 (24)
Receiving special school as a result of statementing	5 (4)	1	2	1	1
Attending a special school or class	3 (3)	1	1	0	1
Score >3 in speaking/listening	22 (19)	4 (33)	3 (14)	7 (18)	8 (18)
Score >3 in writing/composition	37 (32)	6 (50)	3 (14)	13 (34)	15 (33)
Score >3 in fine motor skills	36 (31)	6 (50)	4 (18)	11 (29)	15 (33)
Score >3 in mathematics	34 (29)	5 (42)	5 (23)	11 (29)	14 (31)
Score >3 in reading	25 (21)	3 (25)	4 (18)	8 (21)	10 (22)
Score >3 in physical education	14 (12)	4 (33)	3 (14)	3 (8)	4 (9)

Proportion of all children receiving statement of special educational needs in Oxfordshire, 1.74%.

treatments). Three parents replied but did not wish to answer the questionnaire, and one child was educated at home. Of the 176 eligible for follow up, there were 135 singletons, 38 twins, and three triplets. The mean gestational age was 241 days (34.3 weeks) and the median birth weight 2180 g (range 1060–4200). There were 80 girls and 96 boys. A total of 147 were admitted to special care baby units, 26 were managed on postnatal wards, and this information was unavailable for three. The median maternal age was 27 years, and 89% of the mothers and 88% of the fathers were caucasian. Within the cohort of survivors were 16 babies with congenital abnormalities. Two twins had an abnormality of chromosome 16 which they inherited from their mother; both required statements of special educational needs and received non-teaching assisted help. Seven children had forms of congenital heart disease, one had a unilateral pelviureteric junction obstruction, and one had panhypopituitarism. Five children had very mild abnormalities (inguinal hernia, accessory digit, imperforate hymen) and two had pre-auricular skin tags.

Among the babies whose parents and teachers did not respond, there was a higher proportion of 32 week gestation babies (20.4% *v* 10.3%) and a higher percentage of multiple births (31% *v* 19.7%). Among those for whom the information was available, there was a higher percentage of social class I and II among responders to the parents' questionnaires compared with non-responders (29.6% *v* 38.5%).

Parents reported 17% (21/122) of the children in the study as having visited hospital outpatients in the previous year, and 10% (12/122) had been inpatients for various reasons including respiratory, surgical, and endocrine problems. In all, 70% (85/122) of the children had visited their general practitioner in the previous year. There was no relation between health service use and gestation. Within the whole group, one child had been to a physiotherapist within the last year, five to speech therapists, 15 to eye specialists, one to a psychologist, and four to hearing specialists.

Table 1 shows the numbers of children with problems at school as assessed by teachers. The most common form of additional help needed at school was non-teaching assisted help in 25%. The proportion of children receiving help as a result of statementing was 4%. The overall proportion of children statemented in Oxfordshire is 1.7%. Almost one third of children in this cohort were identified as having school problems by scoring 4 or 5 in writing, fine

motor skills, and mathematics, but there was no significant trend across the gestational age groups (χ^2 for trend not significant).

Tables 2 and 3 show the number of children with normal, borderline, and abnormal behaviour as assessed by the SDQ and reported by parents and teachers. Questionnaires completed by parents and teachers show 18.0% and 18.8% respectively of children scoring abnormally for hyperactivity. This did not appear to be related to gestational age (8.8% of 32 weeks, 21.7% of 33 weeks, 15.8% of 34 weeks, and 21.7% of 35 weeks). Overall 34 children (27.9%) were assessed as being hyperactive by either parent or teacher. However, only 10 (8%) children were assessed as being hyperactive by both. Hyperactivity as reported by both parents and teachers was associated with poor school performance: OR 3.04 (95% CI 1.07 to 8.63) and OR 5.47 (95% CI 1.94 to 15.4) respectively.

Table 4 shows social risk factors for poor school performance. Maternal smoking showed a significant relation to outcome, whereas marital status, maternal age, racial origin, social class, and maternal education did not. Table 5 shows antenatal and perinatal risk factors for poor school performance. Multiparity, severe pre-eclamptic toxaemia, and interventional delivery had a significant association. There was no obvious effect of pre-eclampsia that was not severe, antepartum haemorrhage, prolonged rupture of membranes, multiple pregnancy, or acidosis at birth. Table 6 gives postnatal risk factors. Only nine babies in the cohort were ventilated, and this was not a

Table 2 No (%) children having behaviour problems as reported by parents (n = 122)

	Normal	Borderline	Abnormal
Total difficulties score	93 (76.2)	14 (11.4)	13 (10.6)
Emotional symptoms score	95 (77.8)	13 (10.6)	12 (9.8)
Conduct problems score	91 (74.6)	16 (13.1)	13 (10.6)
Hyperactivity score	89 (72.9)	9 (7.4)	22 (18.0)
Peer problems score	93 (76.2)	13 (10.7)	14 (11.5)
Prosocial behaviour score	105 (86.1)	8 (6.6)	7 (5.7)

Table 3 No (%) children having behaviour problems as reported by teachers (n = 117)

	Normal	Borderline	Abnormal
Total difficulties score	91 (77.7)	15 (12.8)	11 (9.4)
Emotional symptoms score	100 (85.4)	10 (8.5)	7 (6.0)
Conduct problems score	107 (91.4)	5 (4.3)	5 (4.3)
Hyperactivity score	91 (77.7)	4 (3.4)	22 (18.8)
Peer problems score	103 (88.0)	6 (5.1)	8 (6.8)
Prosocial behaviour score	91 (77.7)	11 (9.4)	15 (12.8)

Table 4 Social risk factors for poor school performance

Risk factor	No (%) cases (n = 34)	No(%) controls (n = 80)	Odds ratio (95% CI)
Unmarried mother	7 (20.6)	14 (17.5)	1.22 (0.4 to 3.4)
Maternal smoking*	15 (44.1)	17/75 (22.7)	2.69 (1.1 to 6.4)
Maternal age ≥35 years	5 (14.7)	6 (7.5)	2.13 (0.6 to 7.5)
Non-white mother*	2/32 (6.2)	4/73 (5.5)	1.15 (0.2 to 6.6)
Social class IV to V*	3/33 (9.1)	11/74 (14.9)	0.57 (0.1 to 2.2)
No maternal education after 16 years age*	18 (52.9)	37/78 (47.4)	1.25 (0.6 to 2.8)

*Data not available for some babies.

Table 5 Antenatal and perinatal risk factors for poor school performance

Risk factor	No (%) cases (n=34)	No (%) controls (n=80)	Odds ratio (95% CI)
Multiparity*	20 (58.8)	30/79 (40.0)	2.33 (1.0 to 5.3)
Induced conception*	4/33 (12.1)	9/76 (11.8)	1.03 (0.29 to 3.6)
Pre-eclamptic toxaemia (PET)	8 (23.5)	14 (17.5)	1.45 (0.5 to 3.9)
Severe PET	7 (20.6)	5 (6.2)	3.9 (1.1 to 13.3)
History of antepartum haemorrhage (APH)*	11 (32.3)	24/79 (30.3)	1.1 (0.5 to 2.6)
APH <20 weeks*	8 (23.5)	10/78 (12.8)	2.09 (0.7 to 5.9)
Prolonged rupture of membranes*	5 (14.7)	13/78 (16.7)	0.86 (0.3 to 2.6)
Multiple pregnancy	7 (20.6)	14 (17.5)	1.22 (0.4 to 3.4)
Non-cephalic presentation	8 (23.5)	11 (13.8)	1.93 (0.7 to 5.3)
Interventional delivery	23 (67.6)	35 (43.8)	2.69 (1.2 to 6.3)
Cord arterial gas <7.25*	10/21 (47.6)	25/51 (49.0)	0.95 (0.3 to 2.6)
Cord arterial gas <7.1*	2/21 (9.5)	4/51 (7.8)	1.2 (0.2 to 7.3)

*Data not available for some babies.

Table 6 Neonatal risk factors for poor school performance

Risk factor	No (%) cases (n=34)	No (%) controls (n=80)	Odds ratio (95% CI)
Sex male	25 (73.5)	36 (45.0)	3.4 (1.4 to 8.2)
Intrauterine growth retardation	9 (26.5)	17 (21.1)	1.3 (0.5 to 3.4)
Respiratory illness	19 (55.9)	24 (30)	3.0 (1.3 to 6.8)
Ventilation	3 (8.8)	6 (7.5)	1.2 (0.3 to 5.1)
Oxygen treatment	16 (47.1)	19 (23.8)	2.9 (1.2 to 6.7)
Maximum SBR >250*	4/33 (12.1)	11/71 (15.5)	0.8 (0.2 to 2.6)
Hypothermia*	10/33 (30.3)	18/79 (22.8)	1.5 (0.6 to 3.7)
Hypoglycaemia*	12/18 (66.7)	23/44 (52.3)	1.8 (0.6 to 5.7)
Breast fed on discharge*	11 (32.3)	30/79 (38.0)	0.8 (0.3 to 1.8)
Discharged from SCBU >36 weeks corrected age*	25/32 (78.1)	33/61 (54.1)	3.0 (1.1 to 8.06)

*Data not available for some babies.
SCBU, Special care baby unit; SBR, serum bilirubin.

significant risk factor for poor outcome. However, the presence of respiratory illness and oxygen treatment showed a significant association. Male sex and a prolonged admission, which we arbitrarily defined as discharge from the neonatal unit at greater than 36 weeks postconceptual age, were also significantly related to poor school performance. Intrauterine growth retardation, hypothermia, hypoglycaemia, and hyperbilirubinaemia were not significant. Male sex is a risk factor particularly for problems with speech (RR 5.02; CI 1.55 to 16.2; p<0.01), reading (RR 2.08; CI 1.21 to 6.5; p <0.01), fine motor skills (RR 2.88; CI 1.42 to 5.81; p<0.001), and writing/composition (RR 2.3; CI 1.22 to 4.32; p<0.01) but not mathematical skills (RR 1.12; CI 0.617 to 2.02; p<0.8). Male sex was also a risk factor for teachers' reporting of hyperactivity (OR 4.64; 95% CI 1.42 to 15.2), but not for parents' reporting (OR 1.8; 95% CI 0.63 to 5.17). Maternal age of 35 years or above was a significant risk factor for poor reading (RR 2.36; CI 1.11 to 5.04; p<0.05).

Interactions of risk factors were investigated by entering variables into a logistic regression model. Variables that remained significant, independent of other variables, were discharge from the special baby care unit > 36 weeks corrected age (OR 4.1; 95% CI 1.4 to 12.0) and male sex (OR 3.9; 95% CI 1.4 to 10.6). If discharge from the special baby care unit was removed from the model, the significant variables were respiratory illness (OR 3.1; 95% CI 1.3 to 7.7), male sex (OR 3.7; 95% CI 1.4 to 9.3), and interventional delivery (OR 2.6; 95% CI 1.0 to 6.5).

Univariate analysis showed that babies discharged beyond 36 weeks postconceptual age were more likely to be growth retarded (OR 6.3; 95% CI 1.7 to 23.2), to be female (OR 2.8; 95% CI 1.1 to 6.8), and to have had respiratory illness (OR 2.6; 95% CI 1.0 to 6.2) than those discharged before 36 weeks postconceptual age.

Discussion

We have tested a simple postal questionnaire method of ascertaining the school performance of children born between 32 and 35 weeks gestation. Although non-response is always a problem in such methods, the questionnaire response rate in this study compares well to other postal surveys.[20] In all, 34% of the sample was lost to follow up, the biggest loss being from parents failing to reply to questionnaires (16%). Loss to follow up can cause bias in many ways that mainly underestimate the severity or the frequency of problems.[20–23] Twin pregnancies and those of the lowest gestation were over-represented in our non-responding group as were babies whose duration of stay on the neonatal unit had been beyond 36 weeks corrected gestation. Therefore the incidence of school problems in this study may be an underestimate. However, teachers may overestimate problems in children once they know that they are part of a study. The advantage of using a questionnaire method is that it is relatively inexpensive, easy to use, and can be applied to populations.

Up to a third of children born between 32 and 35 weeks gestation will have some form of school problem. Almost a quarter of children in the study were receiving non-teaching assisted help at school, and 4% were receiving help as a result of an educational statement. This proportion is similar to that described in a recent geographical study of very low birth-weight (VLBW) babies in New Zealand, of whom 22.9% were receiving special educational assistance,[24] but less than that described in a Dutch cohort of VLBW babies, where 38% had special assistance.[25] Direct comparison with other studies is limited, however, as different countries vary in their criteria for deciding which children need help. A study performed in the United Kingdom by Middle *et al*[20], who used a very similar method to our own, found that 24.1% of a cohort of babies < 1500 g were receiving non-teaching assisted help compared with only 18.7% of babies 1500–2499 g and 9.1% of babies > 2500 g. The results shown here for teacher ratings in fine motor skills and mathematics are similar to those expressed for the 1500–2499 g group in her study, whereas for reading and physical education the results are similar to the > 2500 g group, ratings for speaking/listening and

writing/composition lying between her two birth weight groups. We did not study term controls. Other studies using normal population controls suggest that 10–20% of control children perform below the average range, as assessed by teachers.[6 25] Detailed studies of learning difficulties encountered by children who were born with VLBW have identified many areas in which performance is worse than other children.[4–7 10–12] Poor motor skills and ability in children who were low birthweight babies are markers of later learning difficulties and may affect school activities such as writing and physical education.[26] In this study, 32% of children had poor handwriting, but only 12% scored badly in physical education.

The results of both parents' and teachers' questionnaires suggest that an excess of children in this cohort show signs of hyperactivity. Problems within the hyperactivity spectrum, such as difficulty in concentration, have been consistently found in follow up studies of VLBW children,[10 13 14] and these have been evident regardless of whether assessments have been made by parents, teachers, or clinicians. Studies comparing rates of hyperactivity in low birthweight infants and controls have given inconsistent results.[27 28] There is increasing evidence that VLBW children are more likely to suffer a "pure" form of attention deficit disorder which is not associated with the development of conduct disorder, as it is in the general child population.[14] There was, however, no excess of children in this cohort with conduct disorder and we did show that there is an association between reports of hyperactivity from parents and teachers and poor school performance. This has been reported previously in VLBW populations by Pharoah.[13]

There was poor correlation between the results of the parents' and teachers' questionnaires in this study. Goodman[19] reports a high intermeasure correlation for each type of behaviour in the SDQ as a whole. It has been recognised that distinctions can be made between "pervasive" hyperactivity manifest in a variety of settings, "school" hyperactivity, and "home" hyperactivity, and the poor correlation between the parents' and teachers' questionnaires may represent the manifestation of hyperactivity in different settings.

Low social class and limited maternal education were not significantly associated with poor school performance, in contrast with previous studies.[24 29] Within the limited gestational age range of this study, outcome was not associated with gestational age, birth weight, or intrauterine growth retardation. Reduced survival and increased rates of severe disability are related to gestation in very preterm infants, but the relation of milder impairments to gestation is less clear.[24 30] Controversy exists as to the relative importance of birth weight and gestational age as risk factors for adverse outcome.[31–34]

Multiple pregnancies were not a significant risk factor in our study, although the numbers were small. Previous studies disagree as to whether multiples are at risk of poorer outcome or not.[25 32 35] The association of poor school performance with severe pre-eclampsia is interesting. Pre-eclampsia has been shown in some studies of outcome of very preterm (< 32 weeks) and VLBW infants to be associated with a reduced risk of cerebral palsy.[32 36] Sutton *et al*[37], who describe the antecedents and outcomes of severe morbidity in New South Wales term infants, however, cite maternal hypertension as a risk factor.

Our study showed an association between poor outcome at school and respiratory illness. This cohort of babies did not have a large number of very sick infants. Only nine of them were ventilated, the remaining 34 with respiratory illness had a milder course requiring continuous positive airways pressure, oxygen treatment, or no additional respiratory support. Discharge beyond 36 weeks corrected age was a marker of poor outcome. This may reflect severity of respiratory illness but also any cause of delayed feeding.

Despite the methodological limitations of this study, it is clear that children of school age who were born at 32–35 weeks gestation have a very significant risk of educational difficulties. The increased risk of problems should be recognised in this very large group of babies as well as the survivors of extreme prematurity.

Appendix

Pre-eclampsia: the presence of hypertension (diastolic BP > 90 mm Hg) and proteinuria (with or without accompanying biochemical and haematological changes).

Severe pre-eclampsia: significant proteinuria ($\geqslant$ 0.3 mg/24 h) or untreated diastolic blood pressure $\geqslant$ 110 mm Hg or abnormal liver biochemistry or symptomatic pre-eclampsia. Pre-eclampsia leading to eclampsia is included.

Intrauterine growth retardation: birth weight less than 10th centile as defined by Oxford standard percentile charts used for 24–42 week gestation babies.

Antepartum haemorrhage: vaginal bleeding regardless of cause after exclusion of local haemorrhage of genital tract.

Prolonged rupture of membranes: rupture for > 24 hours duration.

Hypoglycaemia: recorded lowest plasma glucose < 2.6 mmol/l. Also included those babies treated for hypoglycaemia with an intravenous infusion or bolus.

Hypothermia: lowest recorded temperature < 36.0°C.

Interventional delivery: any delivery that is not a spontaneous vertex vaginal delivery and includes forceps, ventouse, breech, and lower segment caesarean section.

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